Proposition:- If a sentence that declares a fact that is either true or false but not both.

Ex:- (1.) $1+1=2$ (prop) (T)

(2.) $2+3=65$ (prop) (T)

(3.) $x+1=2$ (not a prop)

(4.) What time is it (1)

(5.) Delhi is the capital of India (prop) (T)

(6.) 5 is an odd no. (P)

(7.) The truth value of a proposition is true denoted by T, if it is a true proposition & the truth value of a prop. is false, denoted by F, if it is a false proposition.

Ex:- What is the truth value of prop $2+3=5$?

Compound Proposition:- are formed from existing proposition using logical operators.

Logical operators are (1.) Negation (2.) Conjuction (3) Disjunction (4) Exclusive OR (5) Implication (6.) Biconditional.

(1.) Negation

Let p be a prop. The negation of p, denoted by $\neg p$ ($\bar{p}$) is the statement "It is not the case that p".

p is true, then ¬p is false

p is false, then ¬p is true.

Ex:- (a) My pc runs Linux

¬p → It is not the case that my pc runs linux

(b) My phone has atleast 32gb of memory

Truth Table for Negation

p	¬p
T	F
F	T

Conjuction

Let p & q be two propositions. Conjuction of p & q, is denoted by $p \wedge q$, is the propn "p and q"

The conjuction $p \wedge q$ is true when both p & q are true & is false otherwise.

Ex:- p:→ 15 is divisible by 3 → T

q:→ 3 is a prime number. → T

$p \wedge q$ → 15 is divisible by 3 & 3 is a prime n

→ T

Ex:- p → Squares are rectangles

q → rectangles have 4 sides

$p \wedge q$ → Squares are rectangles & rec. have 4 sides

Truth Table for the Conjuction of Two Inp

p	q	p ∧ q
T	T	T
T	F	F
F	T	F
F	F	F

Disjunction

Let p & q be propositions. The disjunction of p & q, denoted by p ∨ q, is the proposition "p or q".

The disjunction p ∨ q is false when both p & q are false & is true otherwise.

Ex:- (1) $\sqrt{30} > 6$ or $\sqrt{30} \not< 5$ → F
(F) (F)

(2.) 16 − 4 = 10 or 4 is an even no. → T
(F) (T)

Truth Table for the disjunction of a Tw Inp

P	q	P ∨ q
T	T	T
T	F	T
F	T	T
F	F	F

Exclusive or

Let p & q be two prop. The exclusive of p & q, denoted by $p \oplus q$, is the prop that is true when exactly one of p & q is true & is false otherwise. (but both cannot be true)

Ex:- (1) When you purchase a item, you will get ₹2/- cashback or a voucher worth ₹2/-.

p → When ___ you will get a cashback of ₹2/-

q → " " " " voucher worth ₹2/- (p & q both cannot be true)

Truth Table:

p	q	$p \oplus q$
T	T	F
T	F	T
F	T	T
F	F	F

(5.) Conditional statement

Let p & q be proposition. The proposition "if p then q", denoted by $p \to q$ is called implicat (or cond. statem

In the cond' statement, p is called the hypo & q is called the conclusion.

Ex:- If you try hard for your exam, then you will succeed. $p \to q$

p → you try hard for your exam

q → you succeed.

Case I:- You tried hard for your exam & succeed. → $q \to T$, $p \to T$

$p \to q \to T$

II. - You tried hard for your exam but you failed.

$p \to T$, $q \to F$.

$p \to q \to f$

III. - You haven't tried hard for your exam & you succeeded.

$p \to f$, $q \to T$, $p \to q \to T$ ✓

[$p \to q$ is false only when p is satisfied]

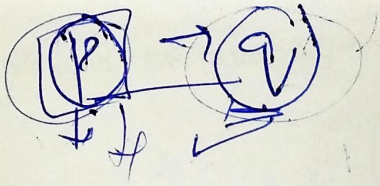
[Here, p is not satisfied, so we cannot make the compound prop^n false]

IV. - You haven't tried hard for your exam & you failed.

$p \to$ false , $q \to$ false. , $p \to q \to T$

p	q	$p \to q$
T	T	T
T	F	F
F	T	T
F	F	T

∴



∴

Biconditional Statement

Let p & q be propositions. The biconditional statement $p \leftrightarrow q$ is the proposition "p if and only if q".

$p \rightarrow q$, $q \rightarrow p$.

Exa. p :→ You can take the flight

q :→ You buy a ticket

$p \leftrightarrow q$:- You can take the flight if and only if you buy a ticket.

$p \rightarrow q$ [If you buy a ticket, then you can take--]

$q \rightarrow p$ [If you have to take the flight, --]

The biconditional statement $p \leftrightarrow q$ is true when p & q have the same truth values, & is false otherwise

Truth Table

p	q	$p \leftrightarrow q$
T	T	T
T	F	F
F	T	F
F	F	T

Q. Construct the truth table of the compound proposition:- $p \vee \neg q$ & $p \wedge q$ & $(p \vee \neg q) \leftrightarrow (p \wedge q)$

p	q	$\neg q$	$p \vee \neg q$	$p \wedge q$	$(p \vee \neg q) \leftrightarrow (p \wedge q)$
T	T	f	T	T	T
T	f	T	T	f	f
f	T	f	f	f	T
f	f	T	T	f	f